

REMARKS

In the Office Action, the Examiner rejected claims 1-5, 7, 9-23 and 26-39 under 35 USC § 102(b). This rejection is fully traversed below.

Claim 12 has been cancelled from the application without prejudice or disclaimer. Claim 1, 7, 22, 27, 37 and 39 has been amended to further clarify the subject matter regarded as the invention. New claim 40 has been added to the application. Claims 1-5, 7, 9-11, 13-23 and 26-40 are pending in the application. Reconsideration of the application is respectfully requested based on the following remarks.

PATENTABILITY OF CLAIMS

In the Office Action, the Examiner rejected claims 1-5 under 35 USC § 102(b) as being anticipated by Matsuo, US Patent No. 6,757,394, and rejected claims 7, 9-23 and 26-39 under 35 USC § 102(b) as being anticipated by Christensen et al. These rejections are fully traversed below.

The present invention pertains to improved approaches to adaptively suppress interfering noise in a multi-microphone directional system of a personal hearing aid device. These approaches operate to adjust a directional null for the multi-microphone directional system so that a dominant noise source is suppressed.

Claim 1 is limited to an adaptive directional sound processing system residing within a personal hearing aid device. A hearing aid device is a small, well-known product that is placed within or proximate to a user's ear and serves to amplify audio sounds to improve the user's ability to hear sound. Claim 1 now specifically states that the "adaptive directional sound processing system resides within a personal hearing aid device adapted for use within or proximate to a user's ear." Nothing in Matsuo teaches or suggests that the microphone array therein described is suitable for use as a hearing aid. Fig. 24 of Matsuo makes reference to a system for detecting the position of the speaker with reference to a camera.

Accordingly, it is submitted that Matsuo fails to teach or suggest claim 1. In addition, it is submitted that dependent claims 2-5 are also patentably distinct from Matsuo for at least the same reasons as claim 1. Accordingly, it is respectfully requested that the Examiner withdraw the rejection of claims 1-5 under 35 USC § 102(b) as being anticipated by Matsuo.

Christensen et al. describes a multiple microphone dereverberation system. When using two or more spatially separated microphones, multi-path reverberative interference results.

According to one aspect described in Christensen et al., first and second audio signals are provided by spatially separated transducers. "[T]he first audio signal is delayed by a fixed time period and the second audio signal for a time period corresponding to the time difference between said first and second pulses. In this way, the relative delay of said first and second audio signals is altered to align said delayed first and second signals. The aligned first and second signals are summed to produce an output signal with reduced reverberative interference." Christensen et al. col. 2, lines 42-50.

Claim 7 pertains to an adaptive directional sound processing system that includes at least two microphones, a delay circuit having an adaptive delay amount, a logic circuit, and a delay amount determination circuit. According to claim 7, the adaptive delay amount imposed by the delay circuit is controlled by a delay control signal that is produced by the delay amount determination circuit.

Claim 7 recites "a logic circuit operatively connected to said microphones and said delay circuit, said logic circuit producing an output signal from a difference from the electronic sound signal from said first microphone and the electronic sound signal from said second microphone after being adaptively delayed by said delay circuit" (claim 7, lines 6-9). In rejecting claim 7, the Examiner asserted that the logic circuit 121 of Christensen et al. teaches the logic circuit recited in claim 7. Applicant respectfully disagrees. With respect to Christensen et al., the logic circuit that produces an output signal would correspond to the summing circuit 107, not the logic circuit 121. The logic circuit of claim 7 produces an output signal from a difference from the electronic sound signal from the first microphone and the electronic sound signal from the second microphone after being adaptively delayed by the delay circuit. The logic circuit 121 of Christensen et al. does not teach or suggest that an output signal is produced from a difference as recited in claim 7.

In addition, claim 7 recites a delay amount determination circuit that is operatively coupled to receive the output signal from the logic circuit. The Examiner points, with reference to Christensen et al., to element 143 (which is a VCO) as corresponding to the delay amount determination circuit. While the logic circuit 121 of Christensen et al. does provide a control signal back to the delay unit 114 via the VCO 143, the logic circuit 121 of Christensen et al. does not receive the output of the logic circuit (i.e., the summing circuit 107 of Christensen et al.). Therefore, if anything, the logic circuit 121 of Christensen et al. would correspond to the delay amount determination circuit of claim 7. However, the logic circuit 121 of Christensen et al. does not receive the output of the summing circuit 107. Consequently, the logic circuit 121 of Christensen et al. also does not correspond to the delay amount determination circuit of claim 7.

Still further, claim 7 specifies that the “adaptive directional sound processing system resides within a personal hearing aid device adapted for use within or proximate to a user’s ear.” The multiple microphone dereverberation system disclosed in Christensen et al. is for a telephone system or other audio communication system. However, Christensen et al. does not teach or suggest a personal hearing aid device adapted for use within or proximate to a user’s ear.

Accordingly, it is submitted that claim 7 is patentably distinct from Christensen et al. In addition, it is submitted that dependent claims 9-21 which include the limitations of claim 7 through dependency are also patentably distinct from Christensen et al. for at least the same reasons as claim 7.

Claim 22 also pertains to an adaptive directional sound processing system. The adaptive directional sound processing system 22 is generally similar to claim 7, though the logic circuit and the delay amount determination circuit of claim 7 are replaced by logic means and delay determination means, respectively, in claim 22. Nevertheless, for at least the reasons noted above with respect to claim 7, it is submitted that claim 22 is also patentably distinct from Christensen et al.

Claims 23 and 27 are method claims that operate to provide directional noise suppression. For reasons similar to those noted above, it is submitted that claims 23 and 27 are also patentably distinct from Christensen et al. In addition, it is submitted that dependent claims 26 and 28-36 are also patentably distinct for at least the same reasons as their corresponding independent claim.

Claim 37 has been amended to clarify that sound signals from one of the microphones are concurrently delayed by a plurality of different delay amounts, and used to produce a plurality of difference signals. Claim 39 has been amended to clarify that the recited plurality of delay circuits delay the electronic sound signal from one of the microphones by different delay amounts. Such clarification further distinguishes claims 37-39 from Christensen et al.

Based on the foregoing, it is submitted that claims 1-5, 7, 9-23 and 26-39 are patentably distinct from Matsuo or Christensen et al. Although the above discussion concentrates on the features of independent claims, it should be noted that the additional limitations recited in the independent claims or the dependent claims are not further discussed as the above-discussed limitations are clearly sufficient to distinguish the claimed invention from Matsuo or Christensen et al. Thus, it is respectfully requested that the Examiner withdraw the rejections under 35 USC § 102(b).

INFORMATION DISCLOSURE STATEMENT

With respect to the Information Disclosure Statement filed October 15, 2002 (mailed October 9, 2002), Applicant thanks the Examiner for returning the PTO-1449 associated with the Information Disclosure Statement, thereby indicating consideration of the references indicated thereon. However, Applicant notes that the Examiner crossed out four U.S. Patent documents from such submission without explanation. The Examiner indicated by telephone on December 20, 2005 that said references were likely crossed out due to being deemed not relevant to examination. It is respectfully requested that the Examiner confirm same in next Office Communication.

SUMMARY

It is submitted that the rejections under 35 USC § 102(b) should be withdrawn. Reconsideration of the application and an early Notice of Allowance of claims 1-5, 7, 9-11, 13-23 and 26-40 are earnestly solicited.

If there are any issues remaining which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number listed below.

Applicant hereby petitions for an extension of time which may be required to maintain the pendency of this case, and any required fee for such extension or any further fee required in connection with the filing of this Amendment is to be charged to Deposit Account No. 50-0388 (Order No. AUD1P004C1).

Respectfully submitted,
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